# In-stream Habitat Availability Assessment
## Saving Water Through Efficient Allocation

## Background

On a daily basis, water issues and events influence the lives of thousands of citizens in the State of New Mexico. The state has a naturally limited water supply and continues to struggle with requirements for in-state uses, interstate compact delivery obligations, and responsibilities necessitated by the Endangered Species Act, especially under drought conditions. There are three primary consumers of Pecos River and Rio Grande surface waters:

- The State of Texas: Interstate Compact Agreements for both rivers mandate that approximately half of the natural river flow must be delivered by New Mexico to Texas.

- Agriculture: On each river, agriculture accounts for ~70% of the net depletions.

- Endangered Species Act: The amount of water to maintain habitat for the endangered Silvery Minnow on the Rio Grande and the threatened Bluntnose Shiner Minnow on the Pecos is unknown, but enough water must flow through the critical habitat to ensure a sustained population.

**Measurements of water depth, velocity and total cross-section profile at 2-ft increments across the Pecos River.**

Balancing the interests of all water users is a complicated matter. The overarching goal is to efficiently manage river water to satisfy all concerned parties. However, there is a deficiency in the present understanding of the river ecosystems: How much water do the minnows need to survive?
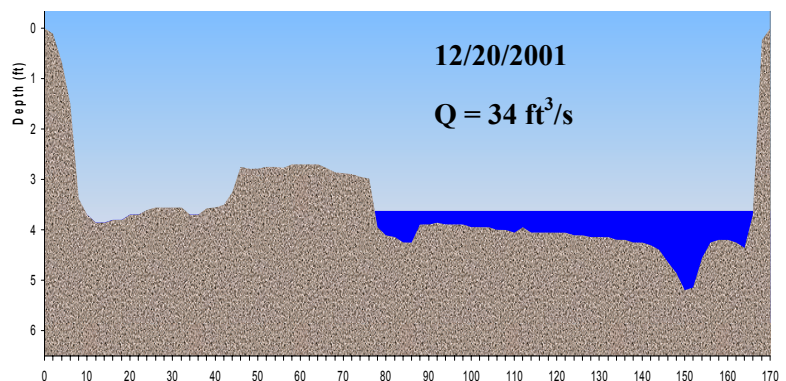
## Outcome

In response, Sandia National Laboratories developed a novel technique for determining available minnow habitat as a function of river flow rate. Our results provide vital information needed to determine the river flows required to maintain sufficient minnow habitat.

12/20/2001

$Q = 34 \text{ ft}^3/\text{s}$

**Total cross-section profile at the ACME gage, Pecos River.**

## Approach

Sandia studied the surface water hydrology and geomorphology of the Rio Grande and Pecos River to help water managers determine flow allocations necessary to support viable minnow populations. Determination of water allocations requires the knowledge and marriage of minnow habitat preference with habitat availability. An exact definition of preferential habitat for both minnow species remains in flux, but it is known to rely on key parameters such as water depth, water velocity, and sediment activity.

Sandia developed an empirical predictive model derived from field data to estimate water depth, wetted area, wetted perimeter, velocity, and sediment activity as a function of river discharge. The model is

calibrated and validated with field measurements and estimates total linear width or wetted area of river that establishes available minnow habitat. The intent of the model is to provide hydrological information that will enable informed decisions about water management practices during low-flow conditions to aid conservation (i.e., when supplemental water must be released from upstream reservoirs to meet habitat requirements).

Because the Rio Grande and Pecos River are intermittent and braided there are a range of flow rates that provide preferred habitat. During drought years, it may be prudent to release water at the low end of the flow rate range considered necessary to maintain sufficient habitat. The habitat availability curves developed by SNL can be used to identify optimum flow rates that yield the most habitat for the least flow – maximize the 'bang for buck'.
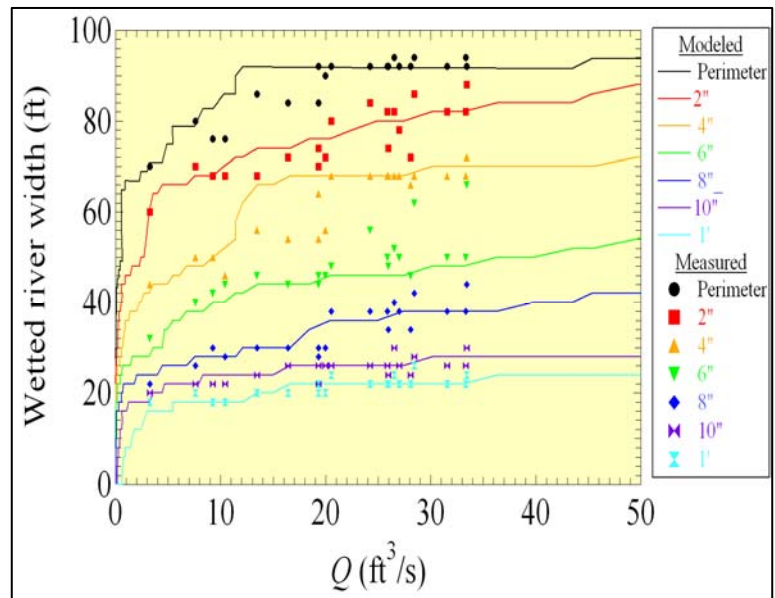


**Modeled (curves) and measured (points) depth availability at one cross-section on the Pecos River.  RMSE ranges are 5-15.**

## Existing Projects

➢ Pecos River:  The first phase of the habitat availability study for  the bluntose shiner is complete (2/2004). This includes analysis of depth and velocity availability at 11 cross-sections throughout the northern critical habitat reach (SAND2004-0302).  Continuing work includes the development of 'sediment activity' availability curves and combining availibility parameters.

➢ Rio Grande: This project is ongoing and scheduled for completion in December of 2005. Currently, field measurements are being conducted at 16 sites between Cochiti and Elephant Butte Reservoirs, quarterly.  A site consists of 1 to 3 paired semi-permanent cross-section markers (i.e. one on each side of the river).



**Mud/ash flow event, Nambe River.**

➢ Nambe River: Two years ago, the Molina Complex Fire burned in the headwaters area of the Nambe River Reservoir. Ash and sediment quickly impacted the Nambe River and flowed into the reservoir devastating the trout population.   The commercial impact to Nambe Pueblo is the revenue loss due to no or limited fishing and swimming at the reservoir.  Also, camping and day use fees have been lost due to reduced visits to the river and trails.  Sandia has begun (2004) an initial assessment of fish habitat availability as a function of flow rate in the Nambe River as well as assessment of sediment transport into the Nambe Reservoir by Nambe River.

## For additional information contact

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